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FOOD AND DIETETICS
Alice Norton

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Food *and* Dietetics

PART III

LESSON PAPER

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FOOD AND DIETETICS

PART III

VEGETABLES

An increasing importance is coming to be attached to the use of vegetables and fruits in the diet. Not only vegetarians but many others have found from experience that it is possible to live largely upon vegetable food, while those who use meat freely lay great stress upon the vegetable accompaniments whether in the form of salads or of cooked vegetables.

Botannical Classification

A study of vegetables from the standpoint of botany would imply their classification according to the parts of the plant used; whether leaf, as in the case of lettuce, cabbage, spinach; stem, as in celery, asparagus, potato (a tuber, or underground stem); root, as in beet, carrot and sweet potato; flower, as cauliflower; or fruit, as squash, cucumber, tomato.

Flavor Classification

From the standpoint of cookery the most important classification is that of *strong flavored* and *sweet flavored* vegetables, since this modifies our method of cooking; right methods leading us to retain all the juices of the latter as far as possible, while we legitimately discard part of the extract of the former. For example, green peas and string beans, young carrots, and squash, should be cooked in a small amount of water, or have the water in which they are cooked concentrated at the end so that it may all be served with the vegetable; while in the case of onions we may well use a large portion of water, and throw it away. It is true that in this latter case we may lose valuable salts and some nutriment, but these we sacrifice for the sake of improved flavor.

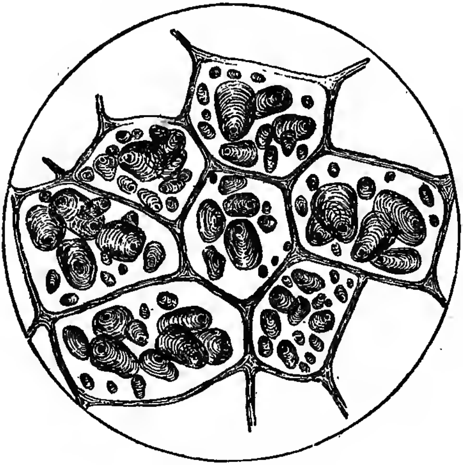
Nutritive Classification

From the standpoint of diet a better classification would be into *nutritive vegetables* and *flavor vegetables*. With the latter we should include those that contain mineral salts, but have little food value. Of this class, lettuce, spinach, cabbage, tomato and cucumber are types; while rice, potatoes, peas, beans and lentils furnish examples of the former. Many vegetables will be on the border line between the two.

The composition of vegetables varies in general from that of animal foods in that here we have the carbohydrates largely represented. The chief carbohydrates of vegetables are starch, sugar, and cellulose of various types.

Cellulose of Vegetables

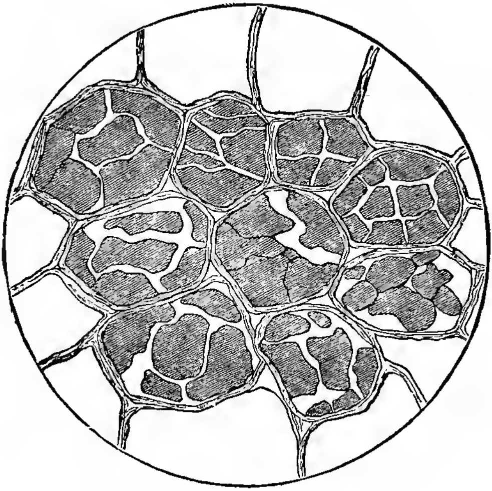
The fact that cellulose forms the framework of the plant and that it is within cellulose walls that the starch as well as the proteid of the plant are contained, is important in two ways. While cellulose is only slightly digested by human beings (only so little of it in young and tender plants really serving as a food that the amount may be neglected), it does have a more or less important function in furnishing the required bulk of food. If one undertakes to live wholly upon a vegetable diet, this bulk generally becomes too great; on the other hand, one of the objections to an exclusively animal diet is in the absence of bulk. Since the digestive juices do not act upon cellulose to any extent, and the nutritive portions of the vegetables are enclosed within walls of this substance, the province of cooking is to so change the cell wall that the nutritive materials may be set free, or the digestive juices penetrate to them.



STARCH OF A POTATO ENCLOSED IN CELLULOSE CELLS.

Effect of Cooking on Cellulose

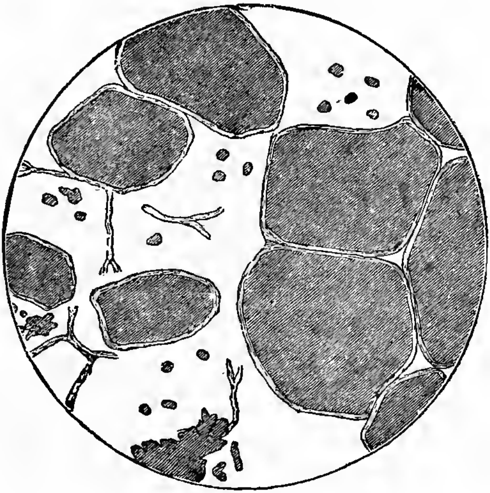
We usually speak of softening the cellulose by means of cooking. Apparently what we really do is to dissolve the intercellular substances that bind the walls together, and thus make it possible for the cell walls to be mechanically ruptured, either in the process of cookery or by the pressure exerted in the mouth. Part at least of this intercellular substance belongs to the pectin group that causes the jelling of fruit juices.



SWELLING OF THE STARCH.

Hydration of the Starch

The first process in rendering the starch of the vegetable digestible is one of hydration. It is important, therefore, that an abundance of water be present when starch is cooked. Some vegetables like the potato contain so much water that the necessary amount for the starch is supplied within the vegetable itself. The grains and other dry vegetables need to have a large amount supplied. The swelling of the starch grains upon hydration is probably an important agent in the rupturing of the cellulose cell wall already referred to.

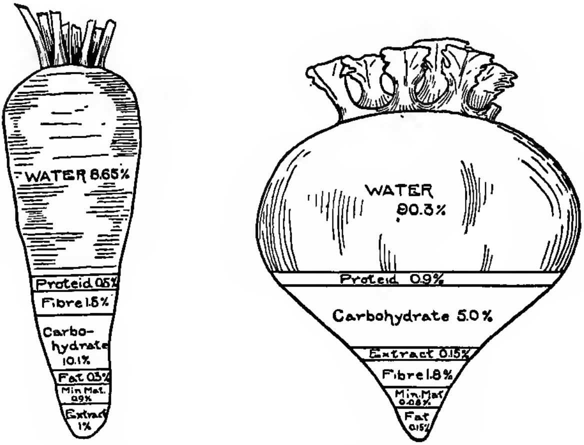


THE CELL WALLS RUPTURED.

Sugar in Vegetables

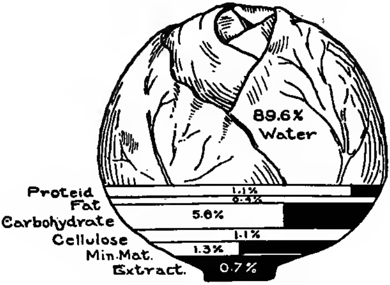
Sugar is the soluble carbohydrate of the vegetable, as starch is the insoluble form in which this nutriment is stored. Some vegetables, such as carrots, show large amounts of sugar, while starch is absent from this part of the plant. Other typical vegetables containing a large amount of sugar are beets, parsnips, artichokes, sweet potato. Onions, cabbage, and some varieties of peas, string beans, squash and sweet corn all contain a fair amount.

Starchy Vegetables Vegetables containing a large amount of starch are represented by potato, sweet potato, rice, peas, beans and lentils. Some vegetables containing a large amount of cellulose are squash, potato, beet, celery, cabbage.



COMPOSITION OF THE CARROT AND TURNIP.
(After Hutchison)

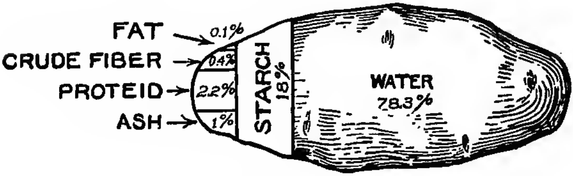
Proteid of Vegetables As a rule, we do not look to the vegetable world for our main supply of proteid, yet some of our vegetables, notably the legumes, do contain an abundant supply of this food principle. Whether this is as available for use in the body as the proteid in meat is often questioned. With ordinary cooking processes it evidently is not, but with long continued heat the matter is different. That there is no inherent difference between vegetable and animal proteid, so far as its digestibility is concerned, would seem to be indicated by the fact that when the vegetable is finely divided, as in the case of some of the vegetable meals, it is absorbed to a greater extent than in its ordinary form. It is said, for instance, that when lentils are soaked and boiled until soft, 60 per cent of their proteid is absorbed, while in the lentil meal 90 per cent is utilized by the body. No careful experiments have been made to see what proportion of the boiled lentils would have been absorbed if the cooking had been continued for several hours. There is every reason,



COMPOSITION OF THE CABBAGE.
Blackened portions represent amount dissolved in cooking.

Digestibility of Vegetable Proteid

however, to think that the percentage would be increased. Anyone who has compared dry peas or beans cooked two hours, or until they have just become soft, with those cooked from eight to twelve hours will realize the difference in the result.



COMPOSITION OF THE POTATO.

The Potato

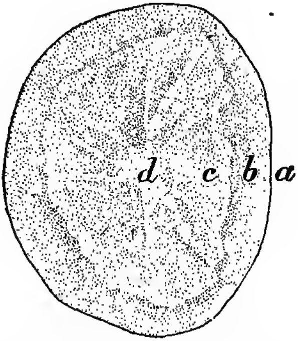
Among the vegetables, the potato, in this country at least, is the most generally used. It has of late been decried as having no food value. This is far from true. It has, of course, a small amount of proteid, some of which is lost in the process of cooking. Its mineral salts are less in amount than in many vegetables, and are partially lost in the cooking. Its chief value as food lies in the starch it contains, and in the fact that its very absence of strong flavor makes it acceptable day after day.

Salts of Vegetables

Vegetables should be in our diet not only for their food value but for their mineral salts as well. The bad effect of the failure to use a certain proportion of vegetables and fruits, has long been known. Scurvy has usually been attributed to this error in diet, while it is quite possible that some minor disorders of the digestion are attributable to the same cause. Cabbage, lettuce, celery, onion, spinach and the different leaves used as greens find their value almost wholly in the presence of mineral salts.

Mushrooms

Mushrooms have often been considered of great value, from the proteid they contain, but it seems certain now that this value has been much exaggerated, and that the reason for using them as articles of food lies in their pleasant flavor and the variety they give, rather than in the amount of nutriment they furnish the system.



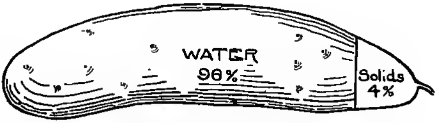
SECTION OF A POTATO.

a—Outer Skin. *b*—Inner Skin or Fibro-vascular Layer. *c*—Flesh. *d*—Inner Flesh.

Digestibility of Vegetables

The digestibility of different vegetables must always be difficult to ascertain, so far as any one individual is concerned. Not only the presence of cellulose, but of acids, as in the tomato, of nitrogeneous substances, such as asparagin found in asparagus, and of volatile flavors, as in the onion, all affect this question.

There has been within a few years a great gain in the abundance and variety of vegetables available. Formerly in winter choice was confined to cabbage, turnip, squash, onions and a few others. Now a visit to the market of a large city, even at the least promising time of year, shows an overwhelming variety of fresh vegetables. If we add to these the numerous canned vegetables of excellent quality available (and these are increasing in variety constantly) and the dried vegetables, like the peas, beans and mushrooms even, that are obtainable, we have no excuse for limiting our diet so far as vegetables are concerned.



COMPOSITION OF THE CUCUMBER.

True economy will consist not in cutting down the supply but in choosing fresh vegetables at the time when each is most abundant and therefore cheapest, and presumably at its best, and in supplementing these by the judicious use of the canned or dried product, not forgetting the ordinary winter vegetables.

Average Composition of Vegetables

NAME	Refuse	Percentage Composition of Edible Portion						
		Water	*Carbohydrates	Fiber	Nitrogenous	Fats	Ash	†Calories, per lb.
Beans, dried	......	12.6	55.2	4.4	22.5	1.8	3.5	1,605
Beans, string	7.0	89.2	5.5	1.9	2.3	.3	.8	195
Peas, dried	......	9.5	57.5	4.5	24.6	1.0	2.9	1,655
Peas, green	45.0	74.6	15.2	1.7	7.0	.5	1.0	465
Potatoes	20.0	78.3	18.0	.4	2.2	.1	1.0	385
Sweet Potatoes	20.0	69.0	26.1	1.3	1.8	.7	1.1	570
Sweet Corn	61.0	75.4	19.2	.5	3.1	1.1	.7	470
Parsnips	20.0	83.0	11.0	2.5	1.6	.5	1.4	300
Carrots	20.0	88.2	8.2	1.1	1.1	.4	1.0	210
Beets	20.0	87.5	8.8	.9	1.6	.1	1.1	215
Turnips	30.0	89.6	6.8	1.3	1.3	.2	.8	185
Onions	10.0	87.6	9.1	.8	1.6	.3	.6	225
Cabbage	15.0	91.5	4.5	1.1	1.6	.3	1.0	145
Spinach	......	92.3	2.3	.9	2.1	.3	2.1	110
Squash	50.0	88.3	8.2	.8	1.4	.5	.8	215
Tomatoes	......	94.3	3.3	.8	.9	.4	.5	105
Lettuce	15.0	94.7	2.2	.9	1.2	.3	.7	90
Celery	20.0	94.5	2.3	1.0	1.1	.1	1.0	85
Cucumbers	15.0	95.4	2.4	.5	.8	.2	.7	80

*Not including fiber.
†Including fiber and thus higher than fuel value available in the body.

The substances grouped under carbohydrates in the above table are chiefly starch, sugar and pectose bodies. Church states that turnips contain no starch or sugar, only pectose, but one of the analyses of the Department of Agriculture showed one sample to contain over 4% of sugar. The carrot contains sugar and pectose, but no starch; parsnips, sugar, starch and pectose. The nitrogenous matter is only in part proteid; in potatoes about 57%; in carrots, onions, cabbage, cucumbers, lettuce, about one-half.

Classification of Fruits

Fruits may, like vegetables, be classified as *flavor* fruits and *food* fruits, and again these two classes will run together so that we shall have difficulty in deciding where certain ones belong. The apple, the orange, the strawberry, although all having a certain food value, are used so largely for their flavor and to give variety, that these may well be put under the head of the flavor fruits. Bananas form, perhaps, the best common example of the food fruits. Bread fruit, so largely used in the tropics, is another representative of this class.

Dietetic Value

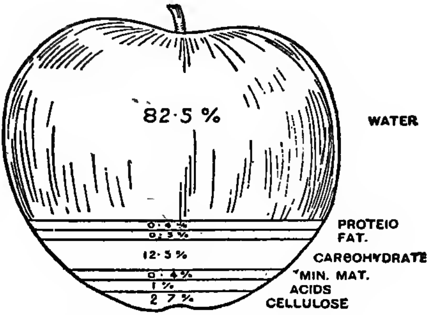
From a dietetic standpoint the most important function of fruits is that of furnishing mineral salts and organic acids to the body. The potash salts are considered especially important. Some fruits, like the pineapple, contain ferments that are said to be aids to digestion. Fruits are generally laxative in effect,—apples, figs, prunes, peaches and berries are particularly effective in this respect, especially if taken between meals or at the beginning of a meal.

Nutritive Value

Their chief nutritive value is given to fruits by the carbohydrate group. This is largely in the form of sugar, while the remainder consists chiefly of vegetable gums, among which may be included the "pectin bodies" that give to fruits their power to form jelly. Starch may be present in unripe fruits, but disappears as the fruit ripens. Bananas, as we use them, contain a small amount of starch. Of fresh fruits very few contain more than one per cent of nitrogenous matter, not all of which is proteid.

Dried Fruits

Dried fruits may be without question put under the food fruits, dates containing sixty-six per cent of carbohydrate, prunes approximately the same amount, figs about sixty-three per cent, while raisins furnish seventy-five per cent. Raisins in this respect stand almost at the head of the list of concentrated foods since they furnish so much nutriment in so small a bulk. When fresh fruits are not obtainable dried fruits may well take their place. These are usually less expensive than fresh fruits, and properly cooked go far to make up for the absence of the fresh varieties.



COMPOSITION OF AN APPLE.
(After Hutchison.)

Canned Fruits

Canned fruits are increasingly used, and many who formerly thought it necessary to put up large amounts of fruit at home, are now purchasing those canned on a commercial scale. Whether this is a wise thing or not depends on the amount of fruit available for the housekeeper at a low cost, the price of sugar, and the time and strength at her disposal. Often the fruit commercially canned is really superior to that prepared at home for the reason that the canning is done where the fruit is easily obtainable in its freshest and most perfect condition. When canned fruit is as reasonable in cost as it is at present, the housekeeper should certainly be very sure that her time cannot be used to better advantage before she undertakes to prepare quantities of fruit at home.

Perhaps no article of diet has increased in use during the last few years so rapidly as fruits. Not only the most hardy, but the more perishable varieties, including berries, are by improved methods of transportation, by the use of refrigerator cars and by increased areas of cultivation made available through a longer season, and at greater distances from the source of supply than ever before. The fruit industries, including the cultivation of the fruit, the great canning and drying establishments, and the transportation of the product, have become of immense importance in the commercial world.

New Varieties

New varieties of fruit produced by careful selection and cross fertilization are constantly appearing. Some of the most important changes that have been induced by cultivation have been the lessening of the proportion of cellulose, the production of seedless varieties, the increase in size and the development of fine flavors.

As in the case of vegetables, the digestibility of fruits is largely an individual matter. Bananas may be eaten freely by many, even by children, while others fail to digest even a small portion. Strawberries, generally considered easily digested, are actual poison to some people. The chief benefit of a table of digestibility is as a guide for experimentation. In feeding a child, for instance, one would try first the fruits considered most digestible.

Digestibility of Fruits

Aside from the personal equation, ease in mastication is one of the important elements in the digestion of fruits, as in the case of other foods. The banana, for instance, easily slips down the throat in large pieces; the blueberry can be swallowed whole, while such a fruit as the apple is naturally more thoroughly masticated, for ease in swallowing, and the orange almost falls apart of itself.

The difference in the digestibility of ripe and unripe fruits is generally attributed to the larger proportion of cellulose in the latter; this and the excess of acids in unripe varieties is held responsible for their ill effects.

Gilman Thomson gives among the commoner fruits easy of digestion: grapes, oranges, lemons, cooked apples, figs, peaches, strawberries and raspberries; while he classifies as somewhat less digestible: melons, prunes, raw apples, pears, apricots, bananas and fresh currants. Dried currants and citron he considers "wholly indigestible," while he gives as the most useful fruits for invalids: lemons, oranges, baked apples, stewed prunes, grapes, banana meal.

Young children and those of delicate digestion should avoid all skin and seeds of fruit.

Average Composition of Fruits

	Refuse	PERCENTAGE COMPOSITION OF EDIBLE PORTION						
		Water	*Corbohydrates	Fiber	Nitrogenous	Fats	Ash	†Calories, per lb.
Bananas	35.	75.3	21.0	1.0	1.3	.6	.8	460
Grapes	25.	77.4	14.9	4.3	1.3	1.6	.5	450
Plums	5.	78.4	20.1	?	1.0	......	.5	395
Cherries	5.	80.9	16.5	.2	1.0	.8	.6	365
Huckle berries	......	81.9	16.6	?	.6	.6	.3	345
Apples	25.	84.6	13.0	1.2	.4	.5	.3	290
Pears	10.	84.4	11.4	2.7	.6	.5	.4	295
Black berries	......	86.3	8.4	2.5	1.3	1.0	.5	270
Apricots	6.	85.0	13.4	?	1.1	......	.5	270
Peaches	6.	85.0	10.5	?	.5	......	.6	......
Oranges	27.	86.9	11.6	?	.8	.2	.5	240
Raspberries (red)	?	85.8	9.7	2.9	1.0	......	.6	255
Cranberries	......	88.9	8.4	1.5	.4	.6	.2	215
Lemons	30.	89.3	7.4	1.1	1.0	.7	.5	205
Pineapple	......	89.3	9.3	.4	.4	.3	3	200
Muskmellon	50.	89.5	7.2	2.1	.6	......	.6	185
Strawberries	5.	90.4	6.0	1.4	1.0	.6	.6	180
Watermelon	60.	92.4	6.7	?	.4	.2	.3	140

* Not including fiber.
† Including fiber.

The carbohydrates of fruits are chiefly in the form of sugar. Nearly all contain pectin bodies and these are most abundant in unripe fruit. The acids of the fruits are here included under the carbohydrates. Apples, pears and peaches contain malic acid; lemons and oranges, citric acid; grapes, tartaric acid; rhubarb, oxalic acid, etc.

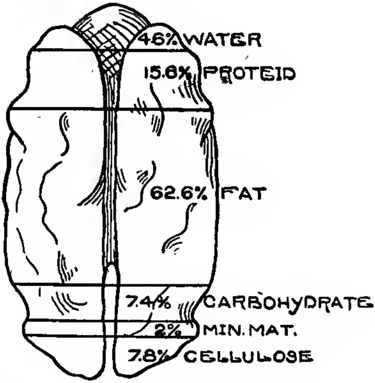
Average Composition of Dried Fruits

	Refuse	PERCENTAGE COMPOSITION OF EDIBLE PORTION					
		Water	*Carbohydrate	Nitrogenous	Fats	Ash	*Calories, per lb.
Dates	10.0	15.4	78.4	2.1	2.8	1.3	1,615
Raisins	10.0	14.6	76.1	2.6	3.3	3.4	1,605
Currants	......	17.2	74.2	2.4	1.7	4.5	1,495
Figs	......	18.8	74.2	4.3	.3	2.4	1,475
Prunes	15.0	22.3	73.3	2.1	......	2.3	1,400
Apples	......	28.1	66.1	1.6	2.2	2.1	1,350
Apricots	......	29.4	62.5	4.7	1.0	2.4	1,290

* Including fibor.

Nutritive Value

The form of fruits that we know as nuts has a very different place in diet from that of the ordinary fruit. We find here foods having a nutritive value that compares favorably with that of the most nutritious substances. Almond kernels for instance contain twenty-one per cent of proteid, fifty-four of fat, and seventeen of carbohydrates, while peanuts are richer still in proteid and also contain a large amount of fat. Indeed, nuts often may well be substituted for meat, and have the advantage that they supply at the same time a certain amount of carbohydrates. Some nuts, as chestnuts, are very rich in the latter. The table given is taken from the experiment station bulletin, *Nuts as Food,* and shows the composition of some of the most common nuts.



COMPOSITION OF AN ENGLISH WALNUT.

Average Composition of Nuts

		Percentage Composition of Edible Portion					
	Refuse	Water	Protein	Fat	Carbohydrates	Ash	Calories, per lb.
Almonds	64.8	4.8	21.0	54.9	17.3	2.0	3030
Brazil Nuts	49.6	2.7	8.6	33.6	3.5	2.0	1545
Filberts	52.1	3.7	15.6	65.3	13.0	2.4	3290
Hickory Nuts	62.2	1.4	5.8	25.5	4.3	.8	1265
Pecans	49.7	2.9	10.3	70.8	14.3	1.7	3445
Walnuts	58.0	2.8	16.7	64.4	14.8	1.3	3305
Chestnuts	16.1	31.0	5.7	6.7	39.0	1.5	1115
Butternuts	86.4	.6	3.8	8.3	.5	.4	430
Cocoanuts	48.8	7.2	2.9	25.9	14.3	.9	1415
Cocoanuts, shredded	.....	3.5	6.3	57.3	31.6	1.3	3125
Pistachio	......	4.2	22.6	54.5	15.6	3.1	3010
Peanuts	26.4	9.3	27.9	42.0	18.7	2.1	2640
Roasted Peanuts	32.6	1.6	30.5	49.2	16.2	2.5	2955
Peanut Butter	......	2.0	29.3	46.6	17.1	5.0	2830

Digestibility of Nuts

Much has been said about the indigestibility of nuts, but this probably comes largely from the fact that nuts are most usually eaten at the end of a hearty meal after the appetite has been completely satisfied. If nuts were more often taken as a substitute for a part of the meat of the meal, there would probably be less difficulty with regard to their digestion. Another important factor in their digestibility as in the case of other foods, is that of their finely divided condition; often they are insufficiently masticated. Some of the nut meals and pastes on the market are valuable because of their fine division, and their use as a meat substitute certainly has a rational basis. Peanut butter is the most common of these preparations.

TEA, COFFEE AND COCOA

The common beverages, tea, coffee and cocoa, are in such general use today that it is difficult to realize that two of them were not introduced into Europe until the seventeenth century, and the other only a hundred years earlier, though other nations had known them long before. Tea drinking began in Japan in 692 A. D., while coffee, though not known to the Greeks and Romans, had been used in Abyssinia and Ethiopia from time immemorial.

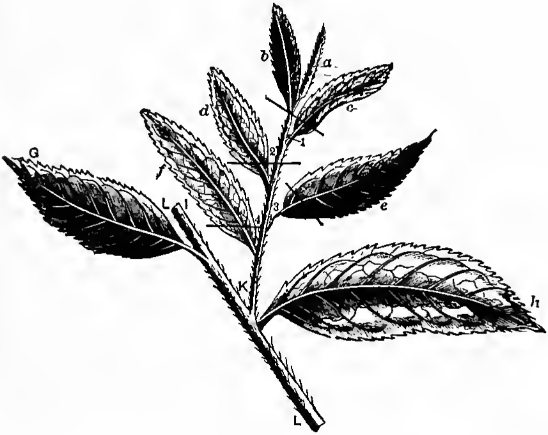
Varieties of Tea

The tea plant seems to be a native of Assam, a province of Burmah, but it has been grown in China and Japan for fifteen hundred years. Two different types of the plant are illustrated by the Assamese and Chinese varieties. The tea of Assam grows luxuriantly, but is sensitive to drought, cold or winds. Its leaves are of bright green, sometimes reaching a size of nine inches in length and three in width, while the young leaf is of soft texture and golden color. It may produce as many as twenty "flushes," or successive crops of young leaf during each picking season. The Chinese plant is tough and hardy, able to endure severities of climate, and to grow in poor soil with deficient moisture. The leaf is smaller, tougher and darker than that of the Assam tea plant. Between these two extremes exist all varieties of tea. Most varieties produce three or four crops a year.

The tea plant produces small white flowers which eventually yield the seed from which cultivated tea is

Pekoe Tea

raised. In cultivating the plant an effort is made to produce abundant young leaf, since good tea is made from this alone. Pekoe tea is the choicest variety. The undeveloped bud at the end of a young shoot is called the pekoe tip, or flowery pekoe. It is said that this tea rarely comes to this country. From it is made Mandarin tea, that commands a very high price in its native country. The next leaves produce orange pekoe and pekoe. Souchong is the next larger leaf and Congou the next. A still larger leaf formerly on the market more generally than now yields Bohea.



TEA LEAVES.

a—Flowery Pekoe. *b*—Orange Pekoe. *c*—Pekoe. *d*—Souchong (first). *e*—Souchong (second). *f*—Congou. *H*—Bohea.

Souchong Tea

Black and Green Tea

All of these different varieties may be made either into black or green tea, though some plants yield leaves better adapted for the manufacture of black tea, and some that serve better for green. Japan tea, for example, is usually made into green, while the Indian are generally black. Chinese tea provides both varieties. The difference between black and green tea is, however, in the method of preparation. Green tea is prepared by withering the leaves in iron vessels over a quick fire, or by steaming them on mats. The leaf is then rolled in order to break up the tissue containing the essential oil. It is then re-heated and subjected to long continued drying over a low fire. In black tea the fresh leaf is spread out to wilt in the sun, then rolled, spread out thinly, moistened and allowed to ferment. The leaves are then dried and fired in a furnace or over a charcoal fire.

Fermentation Process

The chief difference between the black and green tea lies in this fermentation process. By this means, some of the tannic acid in the leaves is changed so that it becomes less soluble. The black tea is thus less astringent than the green. Common varieties of green tea are hyson, corresponding to the pekoe or souchong, and gunpowder, corresponding to congou.

Names

Aside from the varieties given by the stage of growth at which the leaf is plucked and by the method of preparation, teas are named from the different countries or the special district that produces them, or even from the gardens where they are grown.

Japan, Chinese, Indian and Ceylon teas each have their own marked characteristics, while the different districts of China give various kinds, as the oolongs from Formosa or the monings from north China.

Quality

The quality is dependent on the cultivation of the plant, the age of the leaf, and the care in manufacture. Some of the finest tea of China is so high priced that it can be purchased there only by the very rich, while the lowest grades are often made into bricks (brick tea) and sent into the interior. The choicest Japan tea is raised under protection from direct sunlight and is prepared without rolling. It is said to be untouched with the hand after it is put upon the steaming apparatus. Most of the teas sent to the United States might be classed as low middling, with some superior grades. The choice varieties are rarely received.

Composition

The most important constituents of tea are theine, or caffeine, tannic acid and the volatile oil that gives the flavor. Black and green tea contain practically the same amount of oil and caffeine, but black tea has only about half as much tannic acid as green.

Method of Making

The method of making tea has an important influence on the constituents of the beverage. Methods vary all the way from one Japanese fashion of stirring the finely ground tea into warm water and drinking the whole infusion, to the Russian method of bringing the water just to a boil and making a delicate infusion.

The boiling of tea and the practice of keeping the teapot on the stove all day that the brew may be ready at any moment, each results in extracting the largest possible amount of tannic acid from the tea. If tea must stand after making, it should be poured off the leaves immediately. The difference in extract can be easily seen if equal amounts of tea be in one case boiled four or five minutes, in another allowed to stand in cold water, and in a third infused in hot water for the same length of time. If these three results be put into glasses, the depth of color will indicate the difference in material extracted. If a solution of ordinary copperas be made, and a few drops of this added to each, a black, inky substance, a tannate of iron, will form, the amount varying with the tannic acid extracted.

Adulteration of Tea

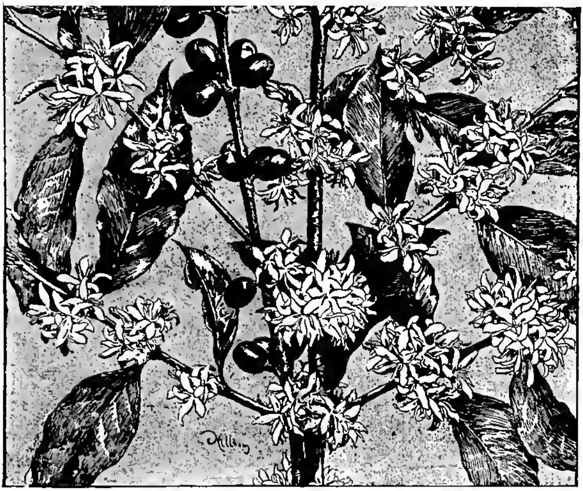
Adulterations of tea are much less common than formerly. The chief fraud practiced is that of substituting an inferior grade for a better. One method of doing this is by facing the tea. This is practiced especially on green teas, giving them a brighter color.

Occasionally spent or exhausted leaves are mixed with fresh ones, thus constituting an adulteration.

Tea tablets are sometimes prepared for the use of travelers by pressing finely ground tea of varying quality into tablets to be dissolved in hot water.

COFFEE

The coffee tree (caffaea arabica) belongs to the same botanical family as the tiny partridge berry found in our northern woods, the familiar button bush of the country roadside, and the gardenia.



COFFEE BEANS AND BLOSSOMS.

Native Home

It is native to Abyssinia, western Africa, and perhaps western Arabia, though it has now been naturalized in a large number of tropical countries. It blooms eight months in the year and with its small fragrant, white blossoms in the axils of the glossy evergreen leaves, it presents an attractive appearance. The ripe coffee berry is dark in color and is a pulpy fruit, somewhat resembling a cherry. The berries have two cells, each containing a single seed, the coffee bean. Three gatherings of coffee are generally made annually. The ripe fruit is dried and then freed from skin and pulp, usually by machinery.

In the east a decoction is frequently made of the unroasted seeds, while in some places the leaf of the tree is used for preparing a drink; and it is said that in the Sultan's coffee the dried pulp of the berry is employed.

Roasting

The roasting of coffee so generally practiced, is chiefly for the purpose of developing its flavor and rendering the beans brittle so that they can be more easily ground, though it has other effects also. Coffee is imported from Mocha, Java, Ceylon, Maracaibo, Porto Rico, and other countries. But 75 per cent of that used in this country comes from Brazil. Our Mocha and Java mixtures are simply different kinds of berries from the same plant.

Preparation

Coffee, unlike tea, may properly be prepared either as an infusion or a decoction; that is, it may be extracted without boiling, or it may be boiled.

Constituents

The important constituents of coffee are caffeine and caffetannic acid, and caffeol, the oil that gives the fragrant aroma and flavor. Caffeol is developed by the process of roasting while the amount of caffeine is lessened. Sugar is present in considerable amounts,

PICKING COFFEE BERRIES.

and most of this is caramelized in the roasting. Fat also is found, sometimes to as much as 15 per cent, and proteid to about 10 per cent. A comparison of the composition of tea and coffee is given below:

Percentage Composition of Coffee

	Raw.	Roasted.
Moisture	8.98	0.63
Caffeine	1.08	0.82
Saccharine matter	9.55	0.43
Caffeic acid	8.46	4.74
Alcoholic extract	6.90	14.14
Fat and oil	12.60	13.59
Lugumin and albumen	9.87	11.23
Dextrin	0.87	1.24
Cellulose and insoluble coloring matter	37.95	48.62
Ash	3.74	4.56

Percentage Composition of Tea

	Unprepared Leaves.	Green Tea.	Black Tea.
Caffeine or theine	3.30	3.20	3.30
Ether extract	6.49	5.52	5.82
Hot-water extract	50.97	53.74	47,23
Tannin (as gallotannic acid)	12.91	10.64	4.89
Other nitrogen-free extract	27.86	31.43	35.39
Crude protein	37.33	37.43	38.90
Crude fibre	10.44	10.06	10.07
Ash	4.97	4.92	4.93
Nitrogen	5.97	5.99	6.22

Composition of Decoctions

This does not give a fair estimate of the composition of the drinks since we use more coffee to the cup than tea. Hutchison finds that a cup of black coffee contains nearly the same amount of caffeine and tannin as a cup of tea. This depends, of course, very largely upon the methods of preparation. It is generally considered that with our ordinary methods that less tannin is present in coffee than in tea.

Adulterants

The adulterants of coffee are many. One of the commonest is chicory. In France this is often used in order to add a desired flavor. Other adulterants that have been found are roasted peas, beans, wheat, brown bread, charcoal, red slate, and dried pellets consisting of ground peas, pea hulls and cereals held together with molasses. These are met with only in ground coffee. Although at one time artificial coffee beans were manufactured to some extent, they are said to be seldom found today. The adulteration of unground coffee consists rather of the substitution or admixture of cheap or inferior varieties. A simple rough test for the detection of adulteration in coffee consists in shaking some of the sample in cold water. The pure coffee usually floats on the surface while most of the adulterants sink, the grains of chicory coloring the water a brownish red as they fall. Sometimes adulteration can be detected if ground coffee is spread out upon a paper and examined with a magnifying glass. A better protection is afforded, however, by purchasing the coffee unground.

It is said that "the earliest intimation of the introduction of cocoa into England is found in the announcement in the Public Advertiser of Tuesday, 16th June, 1657 (more than a hundred and thirty years after its introduction into Spain), stating that "in Bishopgate street, in Queen's Head alley, at a Frenchman's house, is an excellent West India drink, called chocolate, to be sold, where you may have it ready at any time; and also unmade, at reasonable rates."

Early Use of Cocoa

In spite of this alluring advertisement, it was the beginning of the eighteenth century before chocolate became a fashionable beverage. And even as late as 1832 the consumption of cocoa was very limited, owing to a large duty that existed up to that time. Long before this it had become a great favorite in Spain as it was in Spanish Ameria. In New England a mill for the preparation of chocolate was established in 1765. The chocolate of the early Spanish days must have been somewhat different from the modern article. This is one receipt that is given: "Take a hundred cocoa kernels, two heads of Chili or long peppers, a handful of anise or orjevala, and two of mesachusii or vanille—or, instead, six Alexandria roses, powdered—two drachms of cinnamon, a dozen almonds and as many hazelnuts, a half pound of white sugar, and annotto enough to color it, and you have the king of chocolates."

Cocoa Tree

The cacao tree (theobroma cacao) from which chocolate and cocoa are obtained, is a native of tropical America. It grows to an average height of from thirteen to twenty, or even thirty feet, with a diameter of from five to ten inches. A quaint description of the appearance of the tree is given in the following words: "The cacao-tree almost all the year bears fruit of all ages, which ripens successively, but never grows on the end of little branches, as our fruits in Europe do, but along the trunk and chief boughs, which is not rare in these countries, where several trees do the like. Such an unusual appearance would seem strange in the eyes of Europeans, who have never seen anything of that kind; but, if one examines the matter a little, the philosophical reason of the dis-

FLOWER AND FRUIT OF COCOA TREE.

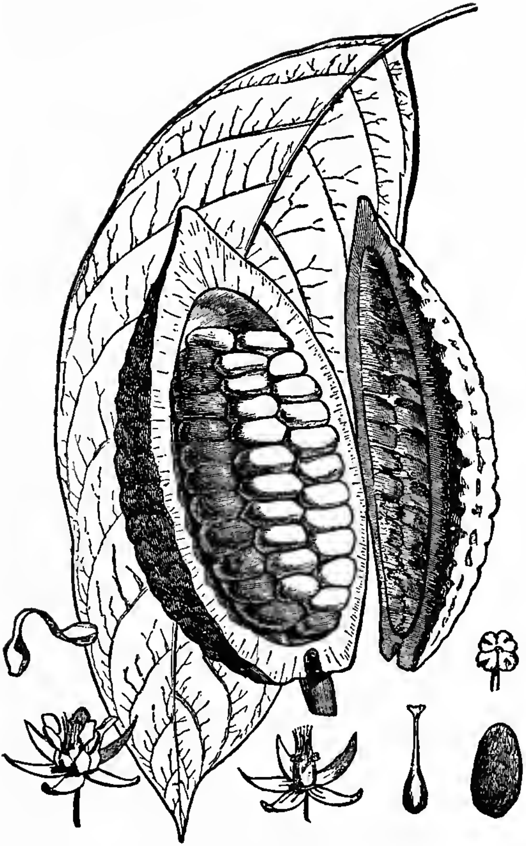
position is very obvious. One may easily apprehend that if nature had placed such bulky fruit at the ends of the branches their great weight must necessarily break them, and the fruit would fall before it came to maturity."

Cocoa is raised from seed, and the tree does not bear fruit till it has reached the fifth or sixth year. It requires an abundance of air and light, but must be shaded from too much direct sun. This is accomplishd by growing large shade trees at frequent intervals in the cocoa plantation.

Cocoa Bean

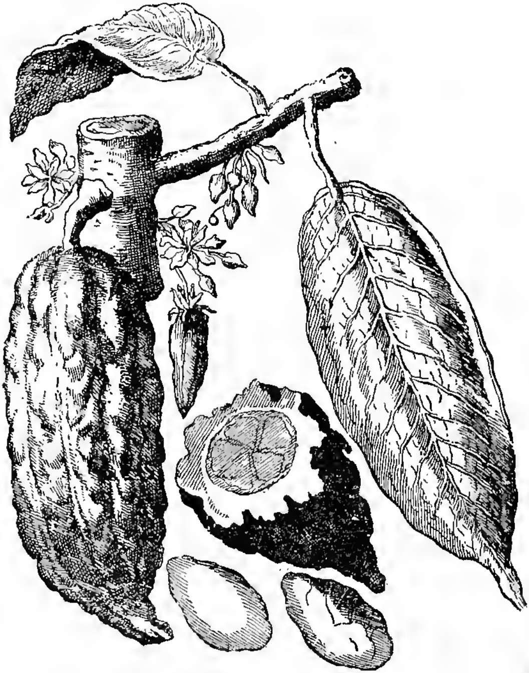
The cocoa beans are the seed of the plant and lie in even rows in a pod not very unlike a large cucumber in shape and size. The first step in the preparation of cocoa is the removal of the bean from this pod and its subjection to a "sweating" or fermentation process. After this the beans are dried in the sun and in this form are shipped to our market.

Beans from different places, Caracas, Trinidad, Maracaibo, Java, and others are imported by the manufacturer who mixes them in different proportions in order to get the result desired. The second step in the process of manufacture is the careful roasting of the beans to develop the flavor, and the crushing or cracking of the nuts and the removal of the thin husk or shell with which the seed is covered, by winnowing. The shells are used in many places for the preparation of a drink. If they are boiled for a long time, a smooth, oily beverage with a pleasant nutty



COCOA BEANS.
Showing Fruit, Flowers and Leaf.

flavor is obtained. The cracked cocoa, or cocoa nibs, as it is called, is also used for preparing a beverage. A mixture of the shells and nibs gives a very satisfactory result.



METHOD OF GROWTH OF COCOA.

The next step in the preparation of chocolate is the grinding of the nibs and running the semi-liquid product into molds. If sugar or any flavoring is to be added, it is done at this time.

Chocolate

Cocoa in its purest form is chocolate with part of the fat removed. In order that it may stay in a powdered condition, it is necessary either to remove this oil or add some form of starchy material. Sometimes flavoring materials such as cinnamon or vanilla are also added.

Theobromine

Cocoa, like tea and coffee, contains an alkaloid called theobromine. Tannin is also present in the raw bean, but is changed during the roasting to cocoa-red which gives the color to the cocoa. A substance somewhat like the caffeol of coffee is also developed during the roasting process. Cocoa beans also contain a large amount of fat—about 50 per cent—with proteids, starch, and other substances in small amounts.

Percentage Composition of Cocoa

	Roasted Cocoa Nibs.
Water	2.72
Ash	3.32
Theobromine	1.44
Other nitrogenous substances	12.12
Crude fibre	2.64
Starch	8.07
Other nitrogen-free substances	19.57
Fat	50.12
	100.00

The food value of clear chocolate has never been questioned. Perhaps the writer of the eighteenth century who is responsible for the following statements may have exaggerated somewhat. He says:

"In reality, if one examines the nature of chocolate a little, with respect to the constitution of aged persons, it seems as though the one was made on purpose to remedy the defects of the other, and that it is truly the panacea of old age."

"There lately died at Martinico a counsellor, about a hundred years old, who, for thirty years past, lived on nothing but chocolate and biscuit. He sometimes, indeed, had a little soup at dinner, but never any fish, flesh, or other victuals. He was, nevertheless, so vigorous and nimble that at fourscore and five he could get on horseback without stirrups."

Food Value

So good a scientist as Liebig says, however: "It is a perfect food, as wholesome as delicious. It is highly nourishing and easily digested, and is fitted to repair wasted strength, preserve health, and prolong life." A simple statement of the case is that we have in chocolate a highly concentrated food, particularly rich in fat, but containing a fair amount of the other food principles. Since it is so concentrated it demands water in abundance. So far as its digestibility is concerned, there is more question. The very presence of so much fat means that it is too rich for some people, while others can digest it with no difficulty. Hutchison tells us that so far as cocoa as a drink is concerned the food value is over-estimated, since the amount we actually use is small. This depends to a large extent upon the manner in which the beverage is prepared. The milk and sugar used add appreciably to the nutriment, and if we follow Thudichum's suggestion, we shall have a beverage of high food value even if one questions its perfection in other respects. He says: "Chocolate should be served in cups and be of sufficient consistency to be eaten with a small spoon, rather than drunk. In this way it was used by the Mexicans; they also ate it with golden spoons. We have tasted the combination, and find chocolate in a red cup and saucer, to be eaten with a golden spoon, aesthetical perfection; both taste and sight are much pleased with the combination."

The possible effect upon digestion of the theobromine present has not been fully determined. It is a substance similar in character to caffeine in coffee and tea. These beverages, however, unlike cocoa, have no food value.

Physiological Effect of Tea, Coffee and Cocoa

The physiological effect upon the system of tea, coffee, and cocoa has been much discussed. Of the three, cocoa seems to have much less influence either in retarding digestion or as a stimulant, though there is reason to think that it is not without stimulating effects.

Tea has a marked influence in lessening the action of the saliva, while both tea and coffee retard digestion, the latter to a less extent than the former. This effect seems due to the tannic acid and the volatile oil. The caffeine itself favors digestion. Both tea and coffee act as stimulants because of the caffeine present. It is this that causes them to be so effective in lessening the feeling of fatigue. Strong coffee is a powerful antidote to narcotics, and is often used where a heart stimulant is needed. Coffee and tea may, because of the tannic acid and other astringent substances present, prove irritants to the mucous membrane of the stomach. This action is greater if the stomach is empty. The stimulating effect also is greater if taken upon an empty stomach.

Personal Equation

The effects of coffee and tea seem to be influenced largely by the personal equation, and quite opposite results are produced in different persons by them; while in most people they tend to produce wakefulness, in others they are conducive to sleep. Some people can use one freely and must refrain completely from the other.

The general conclusion from experiment and observation seems to be that, taken in moderate quantities and at suitable times, they are not injurious to the healthy adult, but that those of a feeble digestion, or who are nervous, should use them in exceedingly small quantities, if at all. Of the two, coffee seems to have the least harmful effect in the majority of cases.

Cereal Coffee

On the market at present there are a large number of coffee substitutes. Some of them undoubtedly are true cereal drinks, and may be used as such, though when a large amount of food value is attributed to them on this account, one cannot help wondering how the insoluble substances of the wheat grain can so largely be present in the drink made from the treatment of wheat kernels in water. Some of the so-called cereal coffees are said to derive their flavor from the volatile oils produced in the roasting of coffee, while others actually contain coffee.

Pure Food Campaign

Probably no food question has been so much discussed of late, or has appealed so generally to the public at large as that of food adulteration. Nearly all the states have passed laws providing for more or less stringent regulations, and the United States Congress has passed a national law and is considering further legislation on the same subject. Magazines and newspapers have taken up the matter; the women's clubs have enthusiastically pressed it and a vigorous "pure food" campaign has been made. This is right and proper; but, either through ignorance, or the belief that it is justifiable to do evil that good may come, many statements are made that are not only sensational in the extreme, but absolutely untrue. Others, while not absolutely wrong, convey a distinctly false impression.

False Impressions

Mrs. Abel, in a recent article, calls attention to some types of such statements by the following illustration:

"A baby has dined on a candy Easter egg and sausage, and the heading reads

DEATH FROM COAL TAR COLOR IN
EASTER CANDY.

"Now sausage is not exactly an infant food and might perhaps have been held responsible for the sad result, but sausage is a trite and common thing, while chemical colors, bearing such a disagreeable name will surely catch the public eye!

"And did we not read one other day that a prominent hygienist had announced that 450,000 babies die yearly in this country of poisoned milk? Few of us had access to census reports from which to learn that this is a much larger number than die yearly from all causes under the ages of five, and perhaps fewer still saw the indignant denial of this official, and learned how a truthful and moderate statement can be distorted."

One of our most reputable city dailies is responsible for the following absurd statement in the report of a speech:

Newspaper Statements

"Dr. Wiley, chief of the national bureau of chemistry, says that nine-tenths of the deaths each year in this country are due to dyspepsia, generally caused by impure food. He declares that the tendency also is to shorten the duration of life, and cites figures to show that 2,000,000 deaths in the United States in the last ten years have been traceable largely to the use of bad food. It is the workingman, the poor man, who cannot afford to buy the higher priced articles of food, who suffers more from these conditions.

"Viewed from an economic standpoint also, the laboring man should be interested. In the report of the Kentucky state board of health for last year the statement is made that for every dollar spent in the purchase of food, 45 cents on the average is paid for adulterations."

The implication here is even worse than the actual statement, for while "impure food" and "bad food" might include water and milk contaminated with typhoid germs, or food that has been allowed to deteriorate by bacterial action till it is in a dangerous condition, it is evident that the meaning intended to be conveyed is that these phrases mean adulterated food.

The same paper in a recent editorial makes the absolutely ungrounded charge that numerous deaths have been caused by the presence of coal tar dyes in candy. It implies that all manufacturers are actuated by greed, and that they care nothing as to the poisonous character of their materials if only they make money.

Glucose

A circular advertising a certain breakfast food, after dividing glucose into good and bad kinds, introduces the following paragraph, saying that the definition is from the dictionary, "Glucose, the trade name of a syrup obtained as an uncrystallizable residue in the manufacture of glucose proper, and containing in addition to some dextrose or glucose, also maltose, dextrine, etc. It is used as a cheap adulterant of syrups, beers, etc. Thus we learn even in this public way that there are harmless and harmful kinds of glucose."

The implication is, of course, that glucose is unfit for food, and no account is taken of the facts that maltose is a sugar perfectly wholesome and digestible, and that dextrine is always an intermediate product in the change of starch into sugar, whether this change is induced by the action of acid as in the manufacture of commercial glucose, or by a ferment as in the change of starch into sugar by the saliva.

No good can come from exaggerated and false statements, and it is the business of every woman who has to do with the purchasing of foods to so inform herself that she shall not be misled.

Classification of Adulterants

We may classify the adulterants of foods, using the term in a broad sense, under three headings: *First,* additions or substitutions used for the sake of cheapening the product; *second,* material such as coloring matter, used either to imitate the natural product or to beautify and make more attractive some foods; *third,* preservatives. Of the first class, by far the greater number are such as affect the pocketbook and not the health. One of the common adulterants of spices, for instance, is starch, and this only means that when such a spice is used a larger amount is needed than would be the case if it were pure. Coffee to which has been added chicory or ground peas or beans, or for which has been substituted an artificial bean, cannot be said to be less wholesome because of this treatment. Cream of tartar, because of its expense, is often adulterated, but again the adulterant is usually harmless. Butterine substituted for butter means the payment on the part of the consumer of a large price for an inexpensive article; but the article consumed is in every way as digestible and wholesome as if no substitution had been made. This and many other articles used to adulterate more expensive ones, have their own value, and if placed upon the market under their own names, might be profitably used. There is no reason to think that corn syrup, or glucose, with a flavoring of caramel is less wholesome than maple syrup, but we all justly object to having the former product labelled with the name of the latter and sold at its price.

Correct Labelling

The crusade against adulterations should then, so far as this class is concerned, be directed toward full and correct *labelling,* and against the possibility of cheap articles being branded as superior ones or sold at the price of the better article. The consumer should demand the right to receive the full equivalent for money paid, and every effort should be made, not only to have right laws passed but to see that frequent tests are made of food materials bought in the open market, and to compel manufacturers to make a correct statement of the ingredients in their wares.

On the part of the housekeeper there should be a knowledge of materials, and ability to make simple tests, while for such tests as imply technical chemical knowledge material should be sent to the board of health or other experts. Most of all, skill in interpreting labels should be cultivated. A bottle purporting to be vanilla and labelled

PURE VANILLA,
Compound

on the face of it is not vanilla, though it may not necessarily be a less wholesome article.

Coloring Matter

The second kind of materials that we have classed as adulterants—the coloring matters, are used generally to satisfy a popular demand. Everyone knows that fresh butter is seldom of the bright yellow color of that on the market, yet few people would purchase an uncolored butter. Because in June, under the best conditions, butter is yellow, we have come to regard that as the only desirable thing. The manufacturer of a certain brand of cheese a few years ago made an attempt to put an uncolored product on the market, though he had formerly used coloring. To his surprise, he could not sell his cheese. The public, accustomed to a deep orange color in that brand, said the white cheese was not "so rich," that it was made of skim milk instead of cream, and refused to accept it.

As soon as the purchasing public has a different standard of values the manufacturer will cease to color his products. He will be content to offer properly canned tomatoes, even though the color is not as brilliant as that of the fresh fruit, and will put upon the market a catsup more attractive though less bright than the modern product. He will devise methods of canning peas and beans that will change their color as little as possible, but will not "green" them to deceive a credulous public. At the same time, the dishonest manufacturer will have less opportunity to conceal the inferiority of poor goods by the addition of color.

Coal Tar Dyes

Color is also used frankly to beautify articles, as in the case of candy, and this seems legitimate when the colors are harmless, and the coloring is delicate. In this case, as in that of other uses of it, the question arises as to the possible harmful effects of the colors used. Of late the so-called coal tar dyes have been frequently employed, and perhaps because of their name much anethema has been directed against them. As a matter of fact, most of the coal tar dyes used are perfectly harmless, with absolutely no physiological effect. They are so strong in coloring power that a very minute amount is all that is necessary to give the desired result. Some of the coal tar dyes are poisonous, and should not be used, though again the fact that so small an amount is required to produce the effect is a protection. Some vegetable dyes are also poison, as well as some of the mineral dyes used before the coal tar products were available, and both of these classes have less coloring power, and so must be used in larger quantities.

That the confectioners are not all "monsters of greed" "reeking" with the desire to make money at the cost of the health and lives of an unsuspecting public, is shown by the fact that long lists of harmless and harmful colors have been made by the National Confectioners' Association, and that the same association has offered resolutions for dealers in confectioners' colors as well for manufacturers of candies, urging only the legitimate use of non-poisonous colors. Legislation and public opinion should unite in forbidding the use of any harmful coloring even in minute quantities, and careful investigation should be made and lists of safe colors presented. An educated public will see no beauty in crude and vivid colors and will demand only the most delicate shades in candies and similar products, and this will mean less coloring of any kind.

Preservatives

As to the use of preservatives in food, there is an honest difference of opinion among experts. It is contended by many that in proper amounts and under proper regulation they are a desirable safe-guard, since they keep in a fresh and wholesome condition foods that would otherwise deteriorate. The amounts necessary are so small that they would seem presumably to have no effect on the users. On the other hand, the user may not be a healthy adult, but an infant or an invalid, presenting quite a different problem. In most cases a little more care would keep the food in proper condition without the resort to doubtful means.

The two sides of the case are stated as follows in the government pamphlet giving the result of the famous borax experiment.

Government Statement

"It is admitted by all who have examined the subject in a critical way, even by the users of preservatives, that in certain maximum quantities the limit of toleration is reached in each individual and positive injury is done. But it is also well recognized that many, if not all, of the usual foods when used in large excess produce injurious results. The many cases of disease produced by overeating, or by eating improperly prepared or poorly cooked foods, or by eating at unusual times, are illustrations of this fact. Upon this basis and upon the further statement that when used in extremely small quantities the preservatives in question cannot be regarded as harmful, is founded the principal argument in favor of the use of the preservatives, aside from the fact that the foods themselves are kept in a better and more wholesome state."

Small Quantities

"It would be useless to contend that the occasional consumption of small quantities of boric acid in a sausage, in butter, or in preserved meat would produce, even upon delicate stomachs, any continuing deleterious effect which could be detected by any of the means at our disposal, but naturally it seems that this admission does not in any way justify the indiscriminate use of this preservative in food products, implying, as it would, the equal right of all other preservatives of a like character to exist in food products without restriction.

"It appears, therefore, that there is no convincing force in the argument for the use of small quantities unless it can be established that there is only a single preservative used in foods, that this preservative is used in only a few foods, that it will be consumed in extremely minute quantities, and that the foods in which it is found are consumed at irregular intervals and in small quantities. On the other hand, the logical conclusion which seems to follow from the data at our disposal is that boric acid and equivalent amounts of borax in certain quantities should be restricted to those cases where the necessity therefor is clearly manifest, and where it is demonstrable that other methods of food preservation are not applicable and that without the use of such a preservative the deleterious effects produced by the foods themselves, by reason of decomposition, would be far greater than could possibly come from the use of the preservative in minimum quantities. In these cases it would also follow, apparently, as a matter of public information and especially for the protection of the young, the sick, and the debilitated, that each article of food should be plainly labeled and branded in regard to the character and quantity of the preservative employed."

Conclusion

More Experiments Needed

Many more experiments need to be conducted before we know the truth in the matter of preservatives. Meanwhile most careful supervision of their use should be exercised when they are allowed at all, and every effort should be directed toward securing cleanly processes of food preparation, and such good conditions that no preservatives should be needed other than the ordinary ones of salt, sugar, spices, with the processes of smoking and sterilization.

The most common preservatives in general use are formaldehyde, salicylic acid, benzoic acid, baking soda, borax and boric acid.

Home Tests

Some of the simpler tests for food adulterants can be successfully used by the housekeeper even without technical training.

The following methods of distinguishing between butter, oleomargarine and renovated butter are taken from the farmers' bulletin on the subject:

The Spoon Test for Butter

In the kitchen the test may be conducted as follows: Using as the source of heat an ordinary kerosene lamp, turned low and with chimney off, melt the sample to be tested (a piece the size of a small chestnut) in an ordinary tablespoon, hastening the process with a splinter of wood (for example, a match). Then, increasing the heat, bring to as brisk a boil as possible, and after the boiling has begun, stir the contents of the spoon *thoroughly*, not neglecting the outer edges, two or three times at intervals during the boiling—always shortly before the boiling ceases. In the laboratory a test tube, a spoon, or sometimes a small tin dish, is used in making this test. From the last-named utensils the test is often called the "spoon test," and sometimes the "pan test."

A gas flame, if available, can be used perhaps more conveniently than a kerosene lamp.

Oleomargarine and renovated butter boil noisily, sputtering (more or less) like a mixture of grease and water when boiled, and produce no foam, or but very little. Renovated butter produces usually a very small amount.

Genuine butter boils usually with less noise, and *produces an abundance of foam.*

To Distinguish Oleomargarine from Genuine and Renovated Butter

Utensils Required.—The utensils required in the test to distinguish oleomargarine from renovated and genuine butters are as follows:

(1) A one-half pint tin "measuring cup," common in kitchen use, marked at the half and quarters; or a plain one-half pint tin measure, ordinary narrow form; or an ordinary small tin cup, 2¾ inches in diameter and 2 inches in height, holding about one gill and a half.

(2). A common kitchen pan, about 9½ inches in diameter at the base.

(3). A small rod of wood, of the thickness of a match and of convenient length for stirring.

(4). A clock or watch.

The Process.—The process for distinguishing oleomargarine from renovated and genuine butters is as follows:

Use sweet skimmed milk, obtained by setting fresh milk in a cool place for twelve to twenty-four hours and removing cream as fully as possible. Half fill with this milk the half-pint cup or measure, or two-thirds fill the smaller cup mentioned, measuring accurately the gill of milk when possible; heat nearly to boiling, add a slightly rounded teaspoonful of the butter or butter substitute, stir with the wooden rod, and continue heating until the milk "boils up," remove at once from the heat and place in the pan (arranged while milk and fat are heating), containing pieces of ice with a very little ice water, the ice to be mostly in pieces of the size of one to two hens' eggs (not smaller, as small fragments melt too rapidly) and sufficient in quantity to cover two-thirds of the bottom of the pan; the water to be in quantity sufficient, when the cup is first placed in the pan, to reach on the outside of the cup to only one-fourth the height of the milk within; any water in excess of that amount must be removed. (This refers to the condition at the beginning of the cooling; later, as the ice melts, the water will rise to a higher level.) Stir the contents of the cup rather rapidly, with a rotary and a cross-wise motion in turn, continuously throughout the test, except during the moment of time required for each stirring of the ice and water in the pan, which must be done thoroughly once every minute by the clock. This is done by moving the cup about, in a circle, following the edge of the pan. Proceed in this manner for ten minutes, unless before that time the fat has gathered or has allowed itself to be easily gathered in a lump or a soft mass, soon hardening. If it so gathers, the sample is oleomargarine; if not, it is either genuine or renovated butter."

It will be seen that by trying both of these tests one may determine which of the three a suspected sample of butter really is.

A method of determining the presence of coal tar dyes in foods has been given in the following words by a recent writer:

Test for Aniline Colors

"Suppose that some cheap currant jelly is to be examined. Stir up about one-fourth of the contents of the tumbler of jelly with about a pint of water in an agate stewpan. Take a piece of white woolen cloth about five or six inches square and wet it thoroughly with boiling water. Care should be taken that it is "all wool," and white is better than cream color. Nun's veiling is an excellent thing to use. Immerse the cloth in the diluted jelly and boil it on the stove for five or ten minutes, stirring it frequently with a small wooden stick. Then remove it and wash well in boiling water. If a dye has been used in the jelly the cloth will be brightly colored.

"Natural colors impart to the wool, when treated in this way, only a dull pinkish-brown color, quite different from the brilliant color of the artificial dye. In order to be absolutely certain, however, it is best to take the dyed wool and boil it with about a tablespoonful of ordinary household ammonia in half a pint of water. After boiling for five minutes, remove the wool, and if the ammonia is colored add to it a third of a cupful of vinegar, immerse it in a second piece of the white woolen cloth and boil it as before. Any color that is imparted to the second piece of cloth is the analine dye, which was dissolved off by the ammonia. The natural color would not be removed from the first cloth by the ammonia, hence would not dye on the second piece. The coloring can be boiled out of sausages and dyed on wool in the same way."

Gelatine Test

"Another interesting way of showing the presence of these dyes, especially in beverages, is to dye them on gelatine. Dissolve one part of gelatine in ten parts of boiling water and pour it into a deep pan to harden. When it is cold, by means of a sharp knife cut it into inch cubes. Place one of these cubes into the suspected liquid and allow it to remain for twenty-four hours, then wash it slightly with cold water and cut through it with a knife. If the color is a natural one it will lightly tinge the outer surface of the cube, but will not penetrate far below the surface, so that the inner portions will be largely free from color. Nearly all of the coal-tar dyes, cochineal and similar colors, will be found to permeate the jelly cube, often to the center.

"One advantage of the dyeing on cloth, however, is that the sample can be preserved as evidence. Nothing is better than ocular proof to convince the average person."

Several other tests for food adulteration have been given under the special foods or in other papers of this series. (See also Bulletin No. 100. *Some Forms of Food Adulteration and Simple Methods for Their Detection.* Price 10 cents, of the Supt. of Documents, Washington, D. C.)

The housekeeper of today must know not only how to select food for the normal member of her household, and how to provide for the varying needs of different ages and activity, but she is many times called upon to direct the diet of an invalid or a delicate child or to provide special foods for those who are sick.

Housekeeper's Province

It is not her province to diagnose a case, or to prescribe special diet, but it is her part to be able intelligently to carry out the directions of a physician. If the invalid is to have starchy foods eliminated from his menu, the housekeeper must know where to turn to obtain foods that will furnish the requisite number of calories without recourse to carbohydrates, and she must be able to prepare such food in a palatable manner; if the diet is to contain a large amount of fat, as in the case of a tubercular patient, she must know where to obtain this food in a digestible form, and, if there is need for economy, how to substitute cheap forms of fat for the more expensive ones. She must know, when the direction is given for a nourishing diet, how to add the egg or milk that is required, or to substitute some other form of food if these are not acceptable.

The housekeeper then, so far as invalid diet is concerned, should be familiar first, with the composition of the ordinary food materials, and second, with the relative digestibility of the different foods so far as that knowledge is available and with their physiological effect. Then, and then only, can she intelligently carry out the directions given.

Food for Children

One of the troublesome problems for the mother is the deciding upon the right food for children, especially for those of school age. While the physician will direct her in the care of her invalids, and in the food necessary for the young baby, she is usually left to work out her own problems so far as the older child is concerned. One reason for this is that comparatively little attention has been given to this matter, while the diet for the baby has been studied for years.

Fortunately the healthy child settles the matter for himself to quite an extent and his own normal appetite guides him up to a certain point. But a normal appetite may easily become perverted, and lead him far astray.

High Proteid

As we have seen, the child needs a larger percentage of proteid in the diet than the adult. At about ten or twelve years the needs of the body rapidly increase, and a far larger amount of food in proportion to body weight is used than in the case of the adult. The mother who has a growing boy of this age is often astonished at the amount of food he eats and seems to need. The chart given on page 51 shows the proportional amounts of the different foods needed at different ages.

Little anxiety need be felt lest the child overeat if the food be *properly masticated* and so taken slowly, if it be of the right kind, and if it be taken at proper times. The latter point is particularly important in its relation to sweets. Candy at the end of a meal for dessert is legitimate and even desirable, but the same article bought at the candy store and eaten on the way home from school before dinner is seriously objectionable, since it satisfies the appetite and lessens the desire for the regular meal without giving adequate nourishment. An over amount of sugar may easily be taken in this way while rarely, if ever, does this happen if the appetite is first largely satisfied with bread and milk, vegetables and meat.

Children's Parties

The often objectionable children's party would be robbed of its evil effects if simple, attractive sandwiches were always provided in abundance before the ice cream and cake were offered, since few children would over-eat of the latter under these circumstances.

If children are to be allowed to eat freely the food must be simple in character and easy of digestion. The ordinary meats, with the exclusion of pork, cooked simply, few "made" dishes, an abundance of vegetables and fruits, only the simplest puddings, no pastry, occasional plain cake (not between meals), plenty of the best of bread and butter, of well cooked cereals and of milk and eggs will furnish variety sufficient for anyone. Tea and coffee are to be reserved for the adult, while cocoa may be used in moderation, chiefly for the milk with which it is made. Highly seasoned foods are to be avoided, as they tend to excite unduly the flow of the digestive juices and gradually make such flow dependent on their stimulation. Their continued use also seems to induce a craving for strong stimulants.

Fat in the Child's Diet

It is necessary to encourage many children to eat more fat than they are inclined to do. This may as legitimately be taken in the form of butter and cream as in that of fat meat, so generally repungant to children. Hutchison suggests that toffee taken at the end of the meal is a good medium for fat when there is difficulty in giving sufficient in other ways.

With young children special attention must be paid to the digestibility of the food. This is frequently a matter of personal idiosyncracy, and when this is the case the matter can only be determined by experiment. The safe way is to begin the diet with foods which are generally easily digested, and to allow those more difficult of digestion only at a later period. If any one article proves unwholesome in the particular case, it should of course be discarded.

Omniverous Tastes

On the other hand, it is most undesirable that children should grow up without learning to like all ordinary foods, and without being able to eat every kind of wholesome food. Such habit cannot be acquired unless a certain variety is provided and unless the child who is old enough be encouraged to try different articles. Even those less easily digestible may at a proper age be taken occasionally with impunity, for the sake of accomplishing this end. Vegetables, while so desirable in the diet, often seem to be an acquired taste.

Above all things there should be no yielding to a child's whims in allowing him to refuse the food offered and to require special provision for himself.

Eating Between Meals

The question of eating between meals is one that frequently arises. During the school period there is difficulty in providing food at sufficiently short intervals. The child who has breakfasted early, often becomes exhausted before the time of the noon meal. This exhaustion sometimes is shown by the apparent stupidity or the inattention and restlessness of the child, and sometimes by extreme irritability. Wherever this interval is a long one, there should be provision for some luncheon during the morning. School lunches have been established in many places and when well conducted serve an excellent purpose. Where the establishment of such a luncheon is not possible, a light lunch carried from home, such as a sandwich, a slice of bread and butter sprinkled with sugar, or even some fruit or sweet chocolate, eaten in the middle of the morning, will do much to preserve the good temper of the child and to make it possible for him to do his work adequately. The child who at home grows hungry between meals should be allowed to have something to eat, provided it be bread and butter, a sandwich, or crackers and milk, or fruit. With the younger children the heartiest meal should be in the middle of the day, and the evening meal should be chosen with especial reference to ease in digestion.

In general, then, the food for children should differ from that of adults, first, in being of the most simple character; second, in the absence of stimulating substances, such as large amounts of spice; third, in the proportions of the different food principles. In addition to this the child should think as little as possible about the food he eats. The constant discussion of the wholesomeness of different articles of diet and the consequent directing of the attention of the child to his own bodily processes seems distinctly harmful. Such discussion should only be used when necessary in order to show the unsuitableness of some especially desired food that must be denied. Good habits in regard to food should be established at this age, rather than theories about it.

Students' Diet

Much has been said in regard to food for older students, and a number of studies of student diet have been made. A few points only can be considered. In the first place, the student is leading a sedentary life, and does not need the hearty food required by the laborer or the one who is doing much outdoor or manual work. The proportion of proteid should be somewhat high in comparison with that of the carbohydrates, and the food should be simple and digestible, in order that but little energy be used in carrying on the processes of digestion.

A good variety is needed, however, and especial care must be exercised to make the food attractive that the appetite may be stimulated. The comparatively small amount of exercise taken generally by the student makes this especially necessary, though no amount of attention paid to the food can or should be a substitute for the healthy appetite.

As in the case of the child, it is frequently wise for the student to eat oftener than at the regular meal time. A glass of milk, a cup of cocoa, or of broth with a cracker in the middle of the morning will often prevent a headache from exhaustion.

Old Age Diet

Old age needs especial consideration in regard to diet as well as youth. After middle life the total amount of food needed lessens somewhat, and the proportion of building material, both of proteids and of mineral salts is less. Again, as in childhood, care must be exercised in regard to digestibility and simplicity of food. Often special conditions of the system must be considered and certain kinds of food avoided, but this is a matter for intelligent following of a physician's directions.

One of the question that frequently arises in regard to diet is that of reducing or increasing flesh by this means. Increase in weight implies that more food is taken into the body than is utilized in the repair of waste and in work. To prevent the storage of fat more work must be performed or less food taken. The well known systems for curing obesity depend chiefly on the reduction of the total amount of food,—sometimes to two-fifths of the standard dietary, and on the lessening of the proportion of fats and carbonydrates, especially of the latter. So radical a treatment as this should only be undertaken under the direction of a physician as there is a possibility of serious injury to health. A diminution of the sugar and starch in the diet and a slight lessening of the total amount eaten with increased light exercise may be undertaken by almost anyone with the result of decreasing the fat of the body.

The converse of course holds true. Rest, a full diet, and one rich in carbohydrate and fat tend to increase the storing of fat in the body, although there is occasionally a person who fails to respond to such treatment. In increasing the diet due regard must be paid to the digestive powers of the individual that they may not be over-taxed.

It is said that some oriental countries, wiser than we, have a custom of paying the physician for keeping the family well, not for restoring the sick member to health. In the absence of such a custom and with physicians not trained for this purpose, the housemother herself must perform this office.

Special diet in disease must be directed by the physician, for the housekeeper, even though she informs herself upon the general principles of such diet, cannot recognize special symptoms that often require individual modification of general rules. She must content herself, then, with the role of preserver of health, and though she can by no means ward off all sickness by the best planned dietary, she can do much toward strengthening the constitution of the members of her family, and making their bodies more resistant to disease.

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Dietetic Value of Bread ($1.50, postage .14). Goodfellow.

Diet in Relation to Age and Activity ($1.00, postage .08). Sir Henry Thompson.

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Food and Its Functions ($1.00, postage .08). James Knight.

Food Inspection and Analysis ($7.50). Albert E. Leach.

Food Products of the world ($1.50, postage .14). Mary E. Green, M. D.

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Food and Feeding ($1.75, postage .14). Sir Henry Thompson.

Food in Health and Disease ($5.00). I. B. Yeo.

Food Materials and their Adulterations ($1.00, postage .08). Ellen H. Richards.

Handbook of Domestic Science and Household Arts ($1.00, postage .10). L. L. W. Wilson.

How to Feed Children ($1.00, postage .10). Louise E. Hogan.

Milk and Its Products ($1.00, postage .08). Wing.

Physiological Economy in Nutrition ($3.00, postage .20). R. H. Chittenden.

Plain Words About Food (Rumford Leaflets) ($1.00, postage .06). E. H. Richards.

Practical Dietetics ($5.00). Gilman Thompson, M. D.

Practical Sanitary and Economic Cooking ($0.40, postage .06). Mary Hinman Abel.

Story of a Grain of Wheat ($1.00, postage .10). W. C. Edgar.

Story of the Living Machine ($0.35, postage .04). H. W. Conn.

Note.—Books may be ordered through the School at the prices given. Any book for which the postage is given may be *borrowed* by members of the School for one week. Send the postage in stamps with the request.

U. S. DEPARTMENT OF AGRICULTURAL PUBLICATIONS

Farmers' Bulletins.

Free, of the Department of Agriculture, Washington, D. C.

No. 34—Meats, Composition and Cooking.
No. 42—Facts About Milk.
No. 63—Care of Milk on the Farm.
No. 74—Milk as Food.
No. 85—Fish as Food.
No. 93—Sugar as Food.
No. 112—Bread and the Principles of Bread Making.
No. 121—Beans, Peas and other Legumes as Food.
No. 128—Eggs and their Uses as Food.
No. 129—Sweet Potatoes.
No. 142—Principles of Nutrition and the Nutritive Value of Food.

No. 175—Home Manufacture and Use of Unfermented Grape Juice.

No. 182—Poultry as Food.

No. 183—Meat on the Farm: Butchering, Curing, and Keeping.

No. 203—Canned Fruit, Preserves and Jellies.

Reprint from Year Book of 1900—The Value of Potatoes as Food.

Reprint from Year Book of 1902—The Cost of Food as Related to Its Nutritive Value.

Circular No. 43—Foods, Nutrients, Food Economy.

Circular No. 46—The Functions and Uses of Food.

Also, see the List of Bulletins and Circulars of U. S. Department of Agriculture for Free Distribution, for contents of the Farmers' Bulletins called "Experimental Work," which have many brief articles of interest, compiled chiefly from State Agricultural Station reports.

STATE AGRICULTURAL EXPERIMENT STATION BULLETINS.

Free, within their own states, usually sent to others free or for a two cent stamp. Apply to the various stations.

Maine Agricultural Experiment Station, Orono, Maine.

Bulletin No. 54—Nuts as Food.

Bulletin No. 65—Coffee Substitutes.

Bulletin No. 84—Cereal Breakfast Foods.

Bulletin No. 118—Cereal Foods.

Illinois Agricultural Experiment Station, Urbana, Ill.

Circular No. 71—Roasting of Beef.

Cornell Agricultural Experiment Station, Ithaca, N. Y.

Bulletin No. 230—The Cooking Quality of Potatoes.

Minnesota Agricultural Experiment Station, St. Paul, Minn.

Bulletin No. 74—Digestibility of Beans.

Bulletin No. 92—Digestibility of Cabbage, Cheese, Rice, Peas and Beans.

Note.—There are many other State bulletins but their results are usually republished in the bulletins of the Office of Experiment Stations.

FOR SALE BULLETINS OF THE OFFICE OF EXPERIMENT STATIONS.

Send coin or money order (stamps not accepted) to the Superintendent of Documents, Washington, D. C.

No. 28—The Chemical Composition of American Food Materials. By W. O. Atwater. Price 5 cents.

No. 29—Dietary Studies at the University of Tennessee in 1895. By Chas. E. Wait, Ph. D. Price 5 cents.

No. 35—Food and Nutrition Investigations in New Jersey. By Edward B. Voorhees. Price 5 cents.

No. 40—Dietary Studies in New Mexico. By Arthur Goss, M. S. Price 5 cents.

No. 43—Losses in Boiling Vegetables and the Composition and Digestibility of Potatoes and Eggs. By H. Snyder, B. S. Price 5 cents.

No. 52—Nutrition Investigations in Pittsburg, Pa. By Isabel Bevier, Ph. M. Price 5 cents.

No. 53—Nutrition Investigations at the University of Tennessee. By Chas. E. Wait, Ph. D. Price 5 cents.

No. 55—Dietary Studies in Chicago. Jane Addams and Caroline L. Hunt. Reported by W. O. Atwater. Price 5 cents.

No. 63—Description of a New Respiration Calorimeter and Experiments on the Conversion of Energy in the Human Body. By W. O. Atwater, Ph. D. Price 10 cents.

No. 84—Nutrition Investigations at the California Agricultural Experiment Station. By M. E. Jaffa, M. S. Price 5 cents.

No. 85—A Report of Investigations on the Digestibility and Nutritive Value of Bread. By Chas. D. Woods. Price 5 cents.

No. 91—Nutrition Investigations at the University of Illinois, North Dakota Agricultural College, and Lake Erie College, Ohio. By H. S. Grindley, J. L. Sammis, E. F. Ladd, Isabel Bevier, and Elizabeth C. Sprague. Price 5 cents.

No. 101—Studies on Bread and Bread Making at the University of Minnesota. By Henry Snyder, B. S. Price 5 cents.

No. 102—Experiments on Losses in Cooking Meat. By H. S. Grindley, D. Sc. Price 5 cents.

No. 107—Nutrition Investigations Among Fruitarians and Chinese at the California Agricultural Experiment Station. By M. E. Jaffa, M. S. Price 5 cents.

No. 126—Studies on the Digestibility and Nutritive Value of Bread at the University of Minnesota in 1900-1902. By Harry Snyder, B. S. Price 5 cents.

No. 129—Dietary Studies in Boston and Springfield, Mass., Philadelphia, Pa., and Chicago, Ill. By Lydia Southard, Ellen H. Richards, Susannah Usher, Bertha M. Terrill, and Amelia Shapleigh. Price 10 cents.

No. 132—Further Investigations Among Fruitarians at the California Agricultural Experiment Station. By M. E. Jaffa, M. S. Price 5 cents.

No. 141—Experiments on Losses in Cooking Meat, 1900-1903. By H. S. Grindley, D. Sc. Price 5 cents.

No. 143—Studies on the Digestibility and Nutritive Value of Bread at the Maine Agricultural Experiment Station, 1899-1903. By C. D. Woods. Price 5 cents.

No. 149—Studies of the Food of Maine Lumbermen. By C. D. Woods. Price 10 cents.

No. 152—Dietary Studies with Harvard University Students. By Edward Mallinckrodt, Jr. Price 5 cents.

No. 156—Studies of the Digestibility and Nutritive Value of Bread and of Macaroni at the University of Minnesota. By Harry Snyder, B. S. Price 10 cents.

No. 162—Studies on the Influence of Cooking upon the Nutritive Value of Meats at the University of Illinois, 1903-1904. By H. S. Grindley, Sc. D. Price 15 cents.

PURE FOOD

Circular No. 16—Officials charged with the Enforcement of Food Laws in the United States and Canada.

Circular No. 17—Standards of Purity for Food Products.

Circular No. 59—Influence of Formaldehyde on the Digestive Enzymes.

Extract No. 44—Butter Substitutes.

Extract No. 221—The Use and Abuse of Food Preservatives.

Extract No. 328—Determination of the Effect of Preservatives on Food and Health.

Extract No. 331—The Adulteration of Drugs.

Farmers' Bulletin, No. 131—Household Tests for the Detection of Oleomargarine and Renovated Butter.

Bulletin No. 13—(Bureau of Chemistry). Part 9, Cereals and Cereal Products. Price 5 cents.

Bulletin No. 13—(Bureau of Chemistry). Part 10, Preserved Meats. Price 10 cents.

Bulletin No. 84—(Bureau of Chemistry). Influence of Food Preservatives on Health, Part I Boric Acid and Borax. Price 30 cents.

Bulletin No. 69—(Bureau of Chemistry). Food and Food Control. (Revised). Parts I, II, III, IV, V, VI, VII, VIII. Price 5 cents each.

National laws to 1905 in Part I and laws of all the States in alphabetical order. Request State laws wanted.

Bulletin No. 100—(Bureau of Chemistry). Some Forms of Food Adulteration and Simple Methods for their Detection. Price 10 cents.

Bulletin No. 46—(Bureau of Animal Industry). The Milk Supply of 200 Cities and Towns. Price 15 cents.

Bulletin No. 70—(Bureau of Animal Industry). Milk Supply of 29 Southern Cities. Price 5 cents.

Bulletin No. 81—(Bureau of Animal Industry). The Milk Supply of Boston, New York, and Philadelphia. Price 5 cents.

Also, see State publications on pure food, especially bulletins and reports of North Dakota Experiment Station, Fargo, N. D.; Wyoming Agricultural Experiment Station, Laramie, Wyo.; Wisconsin Dairy and Food Commission, Madison, Wis.; Pennsylvania Dairy and Food Commission, Harrisburg, Pa.; Massachusetts State Board of Health, Boston, Mass.; Maine Agricultural Experiment Station, Orono, Me.; Nebraska Food Commission, Lincoln, Neb.; Minnesota Dairy and Food Commission, St. Paul, Minn., etc.

PERIODICALS AND LISTS.

Experiment Station Record, published by U. S. Department of Agriculture, Office of Experiment Stations. Price $1.00. Published monthly and contains extracts and summaries of national and state publications, foreign and domestic magazines, and current books relating to food and the work of the various departments.

The *Monthly List of New Publications* of the Department of Agriculture will be sent regularly to all who apply for it. (Free.)

Complete list of bulletins for free distribution and for sale will be sent on application to the Department of Agriculture, also the list food of the Office of Experiment Stations, Bureau of Chemistry, etc.

TEST QUESTIONS

FOOD AND DIETETICS

PART III

Read Carefully. It will be advisable to read the following United States Department of Agriculture Bulletins in connection with this lesson: No. 121—Beans, Peas, and Other Legumes as Food. No. 129—Sweet Potatoes. Reprint—The Value of Potatoes as Food. Circular No. 17—Standards of Purity for Food Products. Circular No. 16—Officials Charged with the Enforcement of Food Laws. Extract No. 221—Use and Abuse of Food Preservatives. *Make your answers full and complete.*

1. In what different ways may vegetables be classified? Classify the following according to each method: Tomatoes, potatoes, sweet potatoes, squash, turnips, beets, green corn, lettuce, spinach, cabbage, green peas, dried peas, string beans, dried lima beans, celery, rice.
2. How does the percentage of water in milk compare with that in vegetables and fruits?
3. How does the presence of cellulose in vegetables affect our use of them?
4. Why do vegetables have an important place in the diet?
5. Compare fruits and nuts as to food value.
6. Name three fruits that have a high food value.
7. Compare tea, coffee and cocoa as beverages.
8. Describe the process of the preparation of tea for the market, and account for the names of different kinds.
9. What are the reasons for prohibiting the adulteration of foods?
10. (a) How ought this to be accomplished? (b) What do you know of the food laws in your own state?

11. Give examples, from your own experience if possible, of misleading statements in regard to food, and show the truth in the matter.
12. Can you suggest any way in which standards may be changed so that the public will not demand such articles as colored butter?
13. Give the arguments for and against the use of preservatives. Which side seems to you to have the better case?
14. Try the two tests for distinguishing butter, butterine, and renovated butter, and report your results.
15. How should the diet of a child, say from five to ten years of age, differ from that of the adult?
16. What is the objection to the use by the child of tea, coffee and highly seasoned food?
17. What control should be exercised over eating between meals on the part of the child?
18. What is the need for fat in the child's diet? In what ways may it be supplied?
19. Make out a menu for three days for a child of about eight.
20. What is the province of the housekeeper in regard to food for the sick?
21. Summarize the chief new points that you have learned from *Food and Dietetics*.
22. To what extent and how has the study of these lessons resulted in the modification of your own diet or that of your family?
23. What questions have you?

Note.—After completing the test, sign your full name.